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PATENT

Attorney Docket No. 5231.6-4003

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): David L. Reese, et al.

Serial No.: ~~09/239,194~~ 91322443

Filed: May 28, 1999

Examiner: Chameli Das

Art Unit: 2151

Title: PROFILING OF COMPUTER PROGRAMS EXECUTING IN VIRTUAL  
MEMORY SYSTEMS

I certify that this correspondence, along with any documents  
referred to therein, is being transmitted by facsimile on April  
15, 2003 to The Commissioner for Patents, Washington D.C.  
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COMMISSIONER FOR PATENTS  
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RESPONSE TO  
RESTRICTION REQUIREMENT OF JANUARY 9, 2003

The Restriction Requirement of January 9, 2003 sets a three months shortened statutory period, expiring April 9, 2003. Applicant petitions for a one-month extension of time, to and including May 9, 2003. Kindly charge the petition fee of \$110.00 to Deposit Account 50-0675, Order No. 5231.6-4003.

The Restriction Requirement proposes to divide the application into Group I (claims 1-15), Group II (claims 16-66), and Group III (claims 67-81).

Applicant elects Group II (claims 16-66), with traverse.

I. Summary of the Argument

Applicant traverses on three separate bases.

First, Groups I and III are misclassified.<sup>1</sup> These mis-classifications appear to be based on a single limitation of a single claim, without consideration of the subject matter of any entire claim, let alone the subject matter of all claims of the Group. Mis-classification will not further

<sup>1</sup> A search that focuses on the subclasses designated in the Office Action is unlikely to develop the most-relevant prior art. Incorrect classification directly harms the public interest by reducing the effectiveness and efficiency of examination, in addition to imposing the costs of an inefficient division of the application.

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Response to Restriction Requirement of January 9, 2003

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the goal of an effective and efficient search. For example, a typical claim to an automobile might recite "a body, an engine having certain novel properties, and four wheels with four rubber tires" – but this does not necessarily mean that the claim is appropriately searched in a subclass directed to "rubber compositions." Similarly, when the claims of this application include a nominal recitation of "address translation" as one component in a claim directed to a larger structure or method, this single recitation should not determine the search strategy of an entire claim group. Rather, each claim and each Group is clearly directed to "profiling" subject matter, which is properly searched in class 717, subclass 130.<sup>2</sup> Because all three groups should be searched in the same class and subclass, there is no "serious search burden," and no basis for division.

Second, the groups recite overlapping subject matter. A search of Group II will all but inevitably result in a search of the subject matter of the other two. There is no "serious search burden" in examining all these claims together.

Third, this disclosure has already been voluntarily divided into twenty-five applications. Because this fine division has already occurred, the claims of this application are directed to patentably-distinct but closely-related aspects of the same invention, and should be examined together.

## II. Overview of the Invention

The most pertinent portion of the disclosure is Section V, pages 61-89 of the specification, and Figs. 4a-4i. "Tapestry" is the name of the system described in the specification.<sup>3</sup> At pages 61-62, the specification reads as follows:

Referring again to **Figs. 1a and 1b**, profiler **400** tracks events by physical address, rather than by virtual address. Thus, a profileable event **416** may be induced by "straight line" flow in virtual address space, when two successive instructions are separated by a physical page boundary, or when a single instruction straddles a virtual page boundary. (As is known in the art, two pages

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<sup>2</sup> It will be understood that this introductory discussion of the invention and the claims (and analogous introductions to the other claims made in this paper) is an indication of the general search field most likely to be relevant to the claim, not a statement of the scope of the claims.

<sup>3</sup> One specific embodiment of the invention is discussed here, in order to provide context to assist the examiner's search. This discussion is directed to assisting in framing an efficient search, and therefore is intended to direct the Examiner to the place where the best prior art is likely to be. It should be understood that this contextual discussion of one particular embodiment is not a limiting discussion of the invention or the claims.

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that are sequential in a virtual address space may be stored far from each other in physical memory.) By managing the X86 pages in the physical address space, Tapestry operates at the level of the X86 hardware being emulated. Thus, the interfaces between Tapestry and the X86 operating system are as well-defined and stable as the X86 architecture itself. This obviates any need to emulate or account for any policies or features managed by the operating system. For instance, Tapestry can run any X86 operating system (any version of Microsoft Windows, Microsoft NT, or IBM OS/2, or any other operating system) without the need to account for different virtual memory policies, process or thread management, or mappings between logical and physical resources, and without any need to modify the operating system. ...

In contrast, known profilers track events by virtual address.

**III. All Three Claim Groups are More Appropriately Searched in Class 717, Subclass 130**

**A. Group I (claims 1-15) is more appropriately searched in class 709, subclass 1**

The Restriction Requirement proposes to search Group I (claims 1-15) in class 711, subclass 202. Claim 1, a representative claim from Group I, recites as follows (paragraph numbering added):

1. A method, comprising:

executing a program in a logical address space of a computer, with an address translation circuit translating address references generated by the program from the program's logical address space to the computer's physical address space;

recording profile information that records physical memory addresses referenced during an execution interval of the program.

In pertinent part, the class definition for class 711, subclass 202 reads as follows:

**CLASS 711 ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MEMORY**

**SECTION I - CLASS DEFINITION**

This class provides, within an electrical computer or digital data processing system, for the following subject matter:

A. Processes and apparatus for addressing memory wherein the processes and apparatus involve significant address manipulating (e.g., combining, translating, or mapping and other techniques for formatting and modifying address data) and are combined with specific memory configurations or memory systems;

**SCOPE OF THE CLASS**

(2) Note. Classification herein requires more than nominal recitation of addressing techniques or of memory accessing or controlling in combination with digital data processing systems or data processing. A nominal combination refers to a combination

wherein one or more of the means or steps thereof are recited so broadly, and without details, as to constitute a mere identification rather than a description of each means or step.

...

**202 Address mapping (e.g., conversion, translation):**

This subclass is indented under subclass 200. Subject matter including translating (i.e., converting) processor memory address data to physical memory address data through a mechanism which defines a correspondence between the addresses.

- (1) Note. The subject matter in this and the indented subclasses is aimed at determining a physical address using a mapping technique.

Claim 1 recites an "address translation circuit" in only "nominal" form, and recites no specific limitation on logical-to-physical address translation. Claim 1 could be practiced, at least theoretically, in the context of any logical-to-physical address translation. Note (2) to the class definition for class 711 states that it is improper to assign a claim to class 711 when it contains only "nominal" recitation of address translation.

In contrast, claim 1 recites specific limitations on the nature of the profiling to be performed. The second paragraph of claim 1 is directed to "recording profile information." This second paragraph has nothing to do with "address translation." All but one of the dependent claims in Group 1 (claims 2-9 and 11-15) recite the word "profiling" or "recording." Very few of the dependent claims recite limitations relating to the address translation. A search that is based on only "nominal" recitation in the first paragraph of claim 1, that fails to consider the subject matter of the second paragraph of claim 1, and fails to consider fourteen of the fifteen claims of the Group, will not be thorough, efficient, or effective.

Rather, the embodiment described in the specification<sup>4</sup> best relates to class 717, subclass 130. In pertinent part, the definition for 717/130 reads as follows

**130 Including instrumentation and profiling:**

... Subject matter including means or steps for inserting monitoring instructions at selected locations in the program code and executing the modified program code along with the inserted instructions, for

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<sup>4</sup> This is only the embodiment in the specification, not the scope of the claims. The claims may well be practiced in contexts outside class 717, subclass 130, and applicant has no objection to searching other potential subclasses, but that does not change the fact that the most efficient and effective search will be the search that focuses on the embodiment that is the subject of many of the dependent claims. The primary search – and the classification for restriction purposes – should be the subclass most related to the embodiments in the disclosure, and claimed in the dependent claims.

the purpose of identifying portions of the code that need to be corrected.

- (1) Note. Subject matter under this subclass includes execution time profilers and program resource utilization monitors (e.g., memory use profilers or pointer utilization profilers).

As the Restriction Requirement notes in its discussion of Group II, class 717/130 is directed to "profiling." The title of the application ("Profiling of Computer Programs Executing In Virtual Memory Systems"), the specification (*see, e.g.*, specification, pages 61 to 89) clarify that the invention relates to "profiling." The section headings in section V of the specification all make clear that the invention is directed to "profiling;" none of these section headings use the word "address translation:"

- A. Overview of profiling (page 61)
- B. Profileable events and event codes (page 63)
- C. Storage form for profiled events (page 68)
- D. Profile information collected for a specific example event – a page straddle (page 72)
- E. Control registers controlling the profiler (page 73)
- F. The profiler state machine and operation of the profiler (page 77)
- G. Determining the five-bit event code from a four-bit [form stored in a profile] (page 86)
- H. Interaction of the profiler, exceptions, and the XP protected/unprotected page property (page 87)
- I. Alternative embodiments [of the profiler] (page 88)

These facts all clarify that prior art with respect to the entirety of these claims, if it exists at all, is much more likely to be found in 717/130 than in class 711. A search of class 711 has a significant risk of being entirely ineffective.

For these reasons, Applicant suggests that Group I should be searched primarily in class 717 subclass 130, instead of 711/202.

**B. Group III (claim 67-81): 711/1 is clearly incorrect. Group III should be searched with Group II in 717/130**

The Restriction Requirement proposes to classify Group III in class 711, subclass 1. This is clearly incorrect. Claim 67 recites as follows:

- 67 A computer, comprising:  
 an instruction pipeline and memory access unit configured to execute instructions in a logical address space of a memory of the computer;  
 an address translation circuit for translating address references generated

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by the program from the program's logical address space to the computer's physical address space; and

profile circuitry cooperatively interconnected with the instruction pipeline and configured to detect, without compiler assistance for execution profiling, occurrence of profileable events occurring in the instruction pipeline, and cooperatively interconnected with the memory access unit to record profile information describing physical memory addresses referenced during an execution interval of the program.

In pertinent part, the definition for subclass 711, subclass 1, reads as follows:

**1 ADDRESSING COMBINED WITH SPECIFIC MEMORY CONFIGURATION OR SYSTEM:**

This subclass is indented under the class definition. Subject matter comprising means or steps for determining one or more values (i.e., address data) that specify one or more locations in a storage medium wherein the means or steps are claimed in combination with a particular configuration or system for storing data.

- (1) Note. Classification herein requires significant address manipulating (i.e., more than nominal recitation of an addressing technique). Significant address manipulating is exemplified by address data processing functions such as combining, translating, mapping, and other techniques associated with forming or modifying address data.
- (2) Note. Means or steps for determining a value that specifies a memory location (i.e., address data) must include more than nominal recitation of processing functions and memory components for classification herein.

For the same reasons discussed above in connection with Group I, class 711 is not a useful search class for these claims. Subclass 1 is particularly inappropriate. Note (1) to subclass 1 instructs that "Classification herein requires significant address manipulating (i.e., more than nominal recitation of an addressing technique)." Claim 67 recites nothing relating to "combining, translating, mapping, and other techniques associated with forming or modifying address data" that are required to meet the definition of subclass 1.<sup>5</sup> 711/1 is entirely inappropriate for claim 67.

Similarly, the dependent claims of Group III (68-81) almost all relate to profiling; none make more than nominal mention of any concept relating to "addressing" in a manner relating to subclass 1.

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<sup>5</sup> Claims 67-81 could be practiced in a processor that performs these functions, to the degree no limitation excludes the possibility. However, theoretical possibilities are not proper bases on which to classify claims for primary search.

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As with Groups I and II, the embodiment described in the specification<sup>6</sup> and the dependent claims relates to "profiling," and thus 717/130 is the most appropriate subclass for search.

**C. Because All Three Groups Should Be Searched Together, There Is No "Serious Search Burden," And Thus No Ground For Restriction**

Applicant traverses the restriction requirement between Groups I and II, and between Groups II and III. The facts as stated by the Examiner do not meet the legal requirements for a proper Restriction. MPEP § 803 states the requirements for a restriction requirement (emphasis added):

There are two criteria for a proper requirement for restriction between patentably distinct inventions:

(1) The inventions must be independent (see MPEP §802.01, §806.04, §808.01) or distinct as claimed (see MPEP §806.05 - § 806.05(i)) and

(2) There must be a serious burden on the examiner if restriction is not required (see MPEP §803.02, §806.04(a)-(j), §808.01(a) and §808.02).

MPEP § 803 clarifies (emphasis added):

If the search and examination of an entire application can be made without serious burden, the examiner must examine it on the merits, even though it includes claims to distinct or independent inventions.

**1. The Restriction Requirement is incomplete**

Applicant concedes that Groups I, II and III are distinct (criterion (1) of MPEP § 803), but traverses under criterion (2). The Restriction Requirement omits any mention of criterion (2) — the Restriction makes no showing of a serious search burden. At a minimum, a Restriction Requirement without such a showing is incomplete, and cannot be made final.

**2. As correctly classified for search, the three Groups are properly examined together**

The Examiner has conceded that Groups I, II and III are all "related" (paragraphs 2 and 3 of the Restriction Requirement). "Related" groups may not be restricted when they are classified together for search. MPEP § 808.02 ("Where, however, the classification is the same and the field of search is the same and there is no clear indication of separate future classification and

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<sup>6</sup> See footnote 4.

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field of search, no reasons exist for dividing among related inventions.”). Because all claims should be searched in the same search class and subclass, restriction is inappropriate.

#### IV. Further Facts Suggest Restriction is Inappropriate

This disclosure has been voluntarily divided into 25 applications. The 24 other applications are listed in the Information Disclosure Statement filed October 19, 2000. Because of this fine division, it should be apparent that the claims in this application are closely related, and that further division is unwarranted.

Further, by the time this application receives its first action on the merits, the application will have been pending for four years. 35 U.S.C. § 154(b)(1)(A)(i) indicates Congressional intent that an application receive its first consideration within fourteen months of filing, and that prosecution conclude within three years. If this restriction is affirmed, the divided claims may well not receive their first consideration for years more. Even now, these delays are far in excess of the statutorily-prescribed guideline for PTO action. *Telecommunications Research and Action Center v. Federal Communications Commission*, 750 F.2d 70, 80 (D.C. Cir. 1984) (“The time agencies take to make decisions must be governed by a ‘rule of reason,’ [and] where Congress has provided a timetable or other indication of the speed with which it expects the agency to proceed ..., that statutory scheme may supply content for this rule of reason.”) Failure to act within this time is “unreasonable delay” in violation of the Administrative Procedure Act, 5 U.S.C. § 555(b). *Id.* Imposing further delay by restricting claims would not be proper.

If division of this application was ever proper, the time for doing so is long past. In view of the undue delay on the part of the Office, far in excess of statutory guideline, and substantial loss of patent term occasioned thereby, it would be entirely inappropriate for the PTO to now divide the application on anything less than the clearest showing of proper division of the application. If grounds for division validly exist at all, they are tenuous at best. No division should be required.

Applicant requests that the application be passed to issue in due course. The Examiner is urged to telephone Applicant's undersigned counsel at the number noted below if it will advance the prosecution of this application, or with any suggestion to resolve any condition that would impede allowance. Enclosed is a Petition for Extension of Time for one month. In the event that further extension of time is required, Applicant petitions for that extension of time required to



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make this response timely. Kindly charge any additional fee, or credit any surplus, to Deposit Account 50-0675, Order No. 5231.6-4003.

Respectfully submitted,  
SCHULTE ROTH & ZABEL

Dated: April 15, 2003

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